APPENDIX F:

EXCERPT OF WISCONSIN PROTOCOL (PRESCRIBED BURNING)

Excerpt from

Wisconsin Karner Blue Butterfly
Habitat Conservation Plan and Environmental Impact Statement

Appendix F. Conservation Protocols and Guidelines for Karner Blue Butterflies

5. Management Tools and Techniques Considering the Karner Blue Butterfly

Prescribed Fire

Prescribed fire currently is the most widely used and accepted tool for barrens management, and may be considered for use on any Karner blue site, providing adherence to the requirements below.

Fire can have variable effects on community structure and composition, depending on the type and timing of the burn, the type of habitat being burned, and interactions with factors such as weather fluctuations (e.g., drought), soils, and other disturbance such as grazing.

Possible Outcomes of Fire Management

Positive

Prescribed fire may benefit Karner blue habitat in the following ways:

- Increased density, above-ground biomass, flowering, and seed production of wild lupine and possibly other legumes

- Increased seed germination and seedling establishment of wild lupine, depending on the timing of the burn, as well as that of other native annual and perennial plants including nectar plants and decreased time needed for lupine seeds to germinate

- Increased flowering of nectaring plants

- Possible benefits where competition from weedy species is minimal from nutrients available through increased subsurface microbial activity stimulated by warmer soil, and immediate nutrient availability in ash.

  [Generally nutrient availability from ash is believed to play a very minor role in grasslands, however on areas with very sterile soils such as many of the sands supporting wild lupine, the role may be more significant.]

- Higher nitrogen content in the plant tissue of lupines *(found in an Ohio study, however cause unknown--perhaps through fire's effects on nitrogen fixation)*

- Control and/or suppression of woody vegetation

- Control of Eurasian cool-season grasses to the favor of native warm-season grasses

  More study is needed on control of invasive vegetation --see "Reported Effects of Burn Timing" under "Timing of Burns," below.

Negative (or Neutral)

Fire is also known to have some negative effects, and the habitat benefits may be insufficient to justify its use. The timing of a prescribed fire may play a crucial role:

- *Heavy mortality of Karner blue eggs, larvae, pupae or adults present in burned area*

- Mortality of other invertebrates present in burned area (effects variable, depends on timing of burn as well)
- Heavy mortality of lupine seeds and seedlings present on or above the soil surface during a burn *(found in an Ohio study)*

- May not reduce woody encroachment by oaks, hazel, sweet fern, etc., and may even encourage brush through resprouting

- Increased drying of soils and hastened senescence of wild lupine so adequate foliage is possibly not available to second-generation larvae and ovipositing adults--applies generally to very dry sites and during drier-than-average years

- Removal of litter may increase exposure of developing eggs, larvae to heat, frost, predators, etc., and remove the micro-habitats occupied by certain animals thus reducing niche diversity

- Increased productivity of native warm-season grasses, especially from cool-season fires, which could be expected to eventually out-compete flowering plants

- May set back some flowering plants important for nectaring (varies with timing of burn)

- May lead to increased erosion, particularly of exposed, burnt soil

- Heavy machinery such as water trucks may cause soil compaction

The main benefits of fire are believed to stem from its role in reducing accumulated plant litter, exposing bare soil, promoting increased soil temperatures, and setting back growth of plants that compete with native, desirable vegetation. Some of these effects may be achieved or enhanced with alternative management tools alone, in combination, or alternatively with fire. Because some degree of Karner blue and other invertebrate mortality is to be expected from fire (mortality of Karners and some other invertebrates may indeed be very high), it should be used very cautiously, especially until further research and monitoring help elucidate the long-term costs and benefits of this tool.

Requirements

A. Number of burn units: Divide contiguous Karner blue breeding habitat into a minimum of *3 burn units* (more if feasible) for a small metapopulation near the minimum viable population size criteria. For metapopulations nearer the large viable size and inhabiting habitat over several square kilometers, swaths of habitat may be managed as single management units as long as occupied areas nearby can provide individuals to repopulate the management unit.

*["*Contiguous*" Karner blue breeding habitat is the total extent of an area supporting wild lupine (even if patchy and scattered) that is occupied by the Karner blue and uninterrupted by obvious barriers to adult butterfly dispersal (usually dense forest). Presume adults to be quite capable of dispersing* at least *300 meters over open areas of suitable habitat, and so include such areas as "contiguous".]*

Never burn an entire population at one time. S*ee Section IV-B above*. For each prescribed burn, leave at least 2 unburned units with an adequate firebreak between them to protect against wildfire or other chance events that may diminish below viable levels, the population on the untreated areas.

Where burn units are larger (i.e., greater than about 40 acres), maintain over the longterm an unburned refugium (a small portion of occupied lupine habitat) within the burn unit by alternative management such as appropriate mowing and herbicide use, or simply exclude an occupied lupine area during a fire for the short-term (by watering down an area prior to burning, for example). Such a measure will promote greater Karner population survival and facilitate post-burn Karner recolonization throughout the treated unit.

B. Rotation: Design burn rotations so that populations can rebuild numbers on burned areas before adjoining source colonies are burned. *For small metapopulations, leave at least 1 of the units adjacent to a burned unit in the condition of having been untreated for the previous 3 years.*

[Rebuilding the population for Karners appears to take at least 2 years, under favorable weather conditions*. Population buildup for other invertebrate species that complete only 1 generation per year presumably will take longer.*]

Annual monitoring of relative abundance both pre- and post-treatment will be necessary to determine average population levels and apparent recovery from treatment.

[Caution: Delay burning if populations decline severely due to weather or other factors (wildfires, flood, etc.)] Burn first the most degraded habitats supporting the fewest Karners, as habitat needs permit.

Recommendations

A. Burn Frequency: The optimal burn frequency per burn unit, with respect to the Karner blue, is no greater than once every 4 years, to allow populations ample time to recover through buildup from adjacent colonies. Burn frequencies of once every 5-10 years are preferred, unless woody succession or exotic invasion poses a more serious threat.

If sites are being burned more frequently than 4 years, consider alternatives. Substitute treatments such as mowing. Explore possibilities for excluding lupine colonies or patches which support the most Karners from burns (e.g., by burning around them). Maintain refugia within units through appropriate mechanical and/or herbicide management that leave significant portions of the population within a unit unharmed.

Burn Frequency for Metapopulations Occupying Large-Scale Barrens Landscapes. or large-scale sites where metapopulation management is underway, the ideal fire frequencies per local deme or subpopulation is no more than once every 5 years.

As always, monitor recolonization of burned areas and buildup of subpopulation levels before subsequent burning of same subpopulation.

B. Firebreaks: Utilize existing artificial or natural breaks such as trails, wetlands, or roads, as much as possible.

Avoid creating mineral breaks. While lupine may readily colonize the bare soil, so may other aggressive exotics. If mineral breaks are necessary to protect human safety, use rotovated or disced breaks rather than fire-plowed breaks. Caution must be used to avoid spreading seeds of weedy plants via equipment.

Monitor for potential invasion of aggressive exotic plants such as spotted knapweed or leafy spurge, and remove such invaders as soon as detected.
Contact the WI DNR's Bureau of Endangered Resources, 608/266-7012 to receive a copy of the "Draft Invasive Species Control Manual" for more information on control of weedy invaders. Be sure to follow pesticide use guidelines specific to the Karner blue *See "Pesticide Use," below.*

C. Type of Burn: Vary the degrees and intensities of burns. Allow or even aim for patchy burns, leaving a mosaic of burned and unburned areas whenever possible and compatible with overall needs of the habitat.

Consider leaving unburned a large lupine/barrens opening near the center of a management unit, to facilitate post-burn Karner blue recolonization throughout the unit, particularly for larger, more block-shaped units.

D. Timing of Burns: Fire is known to have different effects depending on when it occurs. To avoid selectively favoring some community components over others by repeated application of fire during the same time of year, vary the timing of prescribed burns to the extent weather permits.
[Since many of the invertebrate species inhabiting a grassland community probably overwinter in dormant life stages close to or in the soil and under snow compaction, early spring burns may have the least negative impact to the most invertebrate species, however more research is needed to acquire such life cycle information on invertebrate fauna .]

Reported Effects of Burn Timing

Dormant season burns (spring and late fall) typically are used to curb Eurasian cool-season grasses and increase native warm-season grasses (such as big and little bluestem) and summer-blooming native forbs. Late-spring burning when the cool-season grasses are in active growth, is by far the most effective time to burn to achieve these ends, followed by early spring burning. Fall burning is least effective for control of Eurasian cool-season grasses and encouragement of native summer grasses and forbs.

On much of the barrens and brush prairie habitat in Wisconsin, dormant-season burns have not appeared to curb encroaching scrubby oak or other woody brush, however. In fact, frequent fires on these areas may even stimulate denser brush thickets due to increased resprouting. Dormant-season burning also may stimulate sweet fern, which can exclude lupine and other prairie elements.

Many managers and observers have suggested that growing-season burns which could simulate naturally occurring lightning season burns, may set back woody growth much more effectively than dormant-season burns (documented research on this treatment is greatly needed). Growing-season burns also may favor flowering in some species not favored during spring or fall burns.

Summer burns would certainly have very different effects on the fauna present than would dormant season burns. Some invertebrate groups or species that overwinter as eggs or larvae on plants or in plant litter are vulnerable to spring and fall burning, but will be in a more resistant life stage during the summer. These species would be adversely affected or extirpated by repeated use of only dormant-season burning.

Karner blue adults are sedentary, and are weak fliers. They are expected to incur mortality from a summer burn; however, they have at least some physical ability to flee a fire and reproduce on adjacent lupine areas. Populations with eggs and larvae that are present on lupine between the two flight periods during a burn in June and July can be expected to be heavily impacted.

[*A study on two habitat sites at Necedah National Wildlife Refuge showed that some Karner blue adults survived fire treatment. However, proportions of survivorship varied widely with 86.7% observed on one site and 15.0% on the other site.* Much more research is needed in this area.]

Employ spring, summer, and fall burns to the extent possible, and as called for by the habitat condition and desired improvements. *Monitor and document the effects of variously timed burns on the overall community as well as on the relative abundance of Karner blues.*

Mechanical Management

As discussed above, many of the effects of fire on Karner blue habitat may be achieved through mechanical management. Historically, grazing and browsing by large ungulate herds (bison, elk, deer) undoubtedly played a significant interactive role with fire and climate in maintaining our prairie and barrens lands.

[Some long term butterfly monitoring conducted throughout the Midwest shows a much higher relative abundance and diversity of grassland-specialist butterflies on areas that are hayed, mowed or lightly grazed, or left untreated than on areas that are regularly burned.]

Mechanical management tools such as cutting, girdling, mowing, and bush-hogging may be used to simulate aspects of historical grazing and browsing and even to achieve many of the effects of fire, such as reducing litter accumulation (therefore reducing the fuel load for subsequent fire), opening ground for seed germination and seedling establishment, and curbing growth of competing woody and herbaceous plants.

Many of Wisconsin's Karner blue populations and other barrens-associated lepidoptera are found on power line and roadside rights-of-way, maintained solely by mechanical,and sometimes chemical, means.

[A large Karner population at an airport in New York is maintained solely by mowing however the habitat reportedly is quite artificial, and does not constitute a natural community].

The long-term effectiveness of mechanical management in creating and maintaining Karner blue habitat and overall barrens community habitat is unknown. Research in this area is badly needed.

Possible Outcomes of Mechanical Management

Positive

- *Expect significantly lower mortality of Karner blue and other invertebrate fauna* than that resulting from burn management, provided adherence to required guidelines outlined below.

- Removal or control of woody vegetation (may be more effective than fire for many woody species, especially combined with other disturbance techniques)

- Appears to maintain abundant lupine *(with proper timing; see "Mowing" guidelines, below)*

- Increased flowering of lupine and other nectaring plants *(with proper timing; see "Mowing" guidelines, below)*

- Increased seed germination and seedling establishment *(with proper timing; see "Mowing" guidelines, below)*

- Likely to involve soil disturbances that open ground for lupine and nectar plant colonization

- Reduces fuel load so subsequent fires are not as severe (clipped vegetation will decompose more rapidly than standing dead vegetation or "thatch")

- Greater niche diversity than in recently burned areas (duff and short vegetation remain)

- Less potential for erosion expected than on recently burned areas

Negative (or Neutral)

- Leaving clipped vegetation (which may contain Karner eggs) after mowing will reduce the effects produced by bare ground and increased soil temperatures compared to burning *(see "Mowing" guidelines, below)*

- Heavy machinery will disturb and compact soil, and may result in the invasion of exotics. Caution must be used to avoid spreading seeds of weedy plants via equipment as it moves from site to site.

- Waiting until early fall may reduce effectiveness in controlling or suppressing woody brush and will not control Eurasian cool-season grasses *(see "Mowing" guidelines, below)*

- Effects on lupine germination and seedling establishment are unknown

- Mowing during the growing season will negatively impact some plants and animals (like fire, this will vary with timing of treatment)

- Mowing in late summer before the end of August may remove necessary second flight nectar plants for Karner populations in some areas (e.g. roadside habitats within a forested landscape)

Because mechanical management is believed, at least in the short term, to result in lower mortality of Karner blues and other faunal components of the community than does prescribed fire, it should be strongly considered as an alternative or a complement to fire management. *Monitoring the results of mechanical management will be extremely important in helping to increase the knowledge base about its effects, both positive and negative, on Karner blue habitat.*

Mowing Requirements

A. Set blade height no lower than 6-8 inches to avoid the many eggs that will have been deposited on vegetation below that level. The blade may be set lower (4-6 inches) in portions of sites where lupine growth is held back by thatch or litter buildup and the Karner population on site is not at risk.

B. Mow no more frequently than once per year.

C. Divide occupied habitat into at least 2 units each of which supports lupine and nectar sources for adults during both flight periods. See "Expansion of Habitat through Plantings" below. Leave at least one management unit untreated each season.

D. Mow lupine areas no sooner than September 1, once all second-flight females have laid their eggs and died.

E. Let clipped vegetation remain where it falls, as it will likely contain eggs. Clippings may be collected and deposited in another site that supports lupine.

Recommendations

A. Timing: Optimal timing will vary according to habitat needs. Mowing after first frost will allow plants flowering in late summer to serve as nectar sources, complete their annual cycles and set seed. However, fall mowing will have little effect on Eurasian grasses and may have reduced effect on woody brush encroachment.

   Mowing from July through early August may be considered for occasional use, as this may be the best time for controlling woody vegetation (*Please document results!*). Do not mow all management units during this time, however, nor units at high risk of losing Karners due to low numbers or isolation.

   Unless justified by expected overall habitat benefits, do *not* mow lupine areas prior to seed set, the time when the pods have released the seed, which is usually completed by mid-July. If such early mowing is applied in a given year, refrain from mowing prior to lupine seed set for at least 2 subsequent years.

   [Caution: Deer and woodchuck herbivory on lupine, especially on the flowering stalks, can be severe. If this is a recurrent problem, use caution in mowing prior to lupine seed set, as lupine recruitment may already be very low.]

   Note the locations of lupine and nectar patches and consider addressing invasive plant management at separate times within each management unit, e.g. late June mowing of late season nectar areas.

B. If possible, use light equipment likely to have the least impact on the vegetation and Karner blue eggs.

C. If possible use a sickle mower operated from the roadside (non-lupine area), at least periodically, which will have less destructive impact on the vegetation and harbored eggs.

D. When brushing woody growth, if there is a lot of material, remove the slash from the cut area, put in piles no greater than 2 feet high, or chip it (so it doesn't cover lots of lupine. Minimize harm to the butterflies by cutting in the winter.

E. Tree or brush cutting, tree planting, and site scarification including rotovating, discing, and bulldozing are discussed in the "Forest Management Guidelines for the Karner Blue Butterfly" developed by Cynthia Lane at the University of Minnesota, St. Paul, MN. and available from the Service's Green Bay field office.